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ABSTRACT

A study examined the socio-technical impact of computer-mediated communication (CMC) on students' attitudes towards computers, CMC, and their classes. Five classes at universities across America (119 students and faculty) participated in COMCONF, a BITNET computer conference which provided a unique laboratory for observations of CMC processes in an actual application of the technology to specific and practical ends. In addition, each class was administered a follow-up questionnaire at the end of the term to evaluate on-line education, learning styles, life satisfaction, and fun in the classroom. Results indicated that despite differences in class content, instructional methodologies, and CMC technologies, there appear to be no discernable characteristics which clearly distinguish the class studied during the COMCONF exercise. Results showed, however, that the truly distinguishing characteristic of the COMCONF users was the way they separated into the "work mechanics" vs. "organizational straphanger" categories. Finally, results suggest that the degree of integration of CMC into the class requirements as a fundamental part of the classroom process, and the degree of freedom that the students had for choosing classes, were both positively correlated with the emergence of work mechanics as opposed to straphangers in the class. (Six tables of data and three figures are included.) (PRA)

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A Socio-Technical View of COMCONF

Ralph Lewis, Associate Professor, Management/Human Resources Management,
School of Business Administration, California State University, Long Beach

presented to Communication and Technology Interest Group,
International Communication Association, Miami
May 22-25,1992

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BACKGROUND

It is not uncommon for professors to use computer-mediated communication (CMC) in their classes to support class discussion or deliver materials to students, but relatively rare for them to link their classes via CMC to create a virtual classroom constituted of varying disciplines, cultures, and areas of interest.

Comserve was (and is) a listserver hotline hosting an experiment in interuniversity cooperative education. There were in Fall 1991 five classes at universities across America participating in COMCONF. These classes had a common interest in organizational behavior, leadership, motivation, and communication. The classes involved in the discussion are drawn from various academic fields including communication, business, psychology, and social work at the upper division and graduate level. There were 119 student and faculty members participating in the COMCONF computer conference. Most of the students had no previous exposure to computer-mediated communication before participating in this experiment in interuniversity computer-supported discussion. This situation provided a unique "laboratory" for observations of CMC processes in an actual application of the technology to specific and practical ends. The discussion format was left unstructured and the students developed their own communication norms and sociotechnical culture.

HISTORY

COMCONF emerged from a series of discussions on the Rensselaer Polytechnic Institutes' COMSERVE CMC hotline over the spring and summer of 1991. Several instructors at various institutions were discussing the application of computer-mediated communication in their classes on the CMC hotline. Several of these instructors had utilized various CMC technologies in the delivery of instructional materials and to support class student-to-student and student-to-instructor communication. Integrative computer technologies included BBS's, conferencing systems such as CoSy and CONFER, and E-mail. These technologies, however, tended to be campus-centered and discussion turned toward the idea of creating an intercampus collaborative system.

Because all sites had electronic mail capacities via Bitnet, a system of intercampus communication was started. COMSERVE set up a private hotline (PROJECTA-Comserve Special Projects: Working Group A) for the planing activities of the course professors.

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In the Fall of 1991, the COMCONF list was set up for student and instructor discussions. Another hotline list, OBSERVER, was also established so interested parties could view the activities.

Because COMCONF evolved from the experiences of several faculty who had utilized CMC in their classrooms, COMCONF was set up using design principles based on their previous experience with student CMC usage. COMCONF was much more ambitious than past experience with CMC in the classroom as it extended across several campuses utilizing different technologies and course instructional designs. Could this potential Tower of Babel contribute to the educational objective of all of the site participants?

CMC based systems are inherently participatory and collaborative, encouraging all users to put in their 2¢. Even when used by lurkers who do not contribute to the discussion, an active orientation is required, as the lurker must pick and choose which messages to attend to and read. This is a radical departure from more traditional lecture instructional methods which are based primarily on one-way information flow from the instructor to the student. The modern college student is entering a workplace of information or knowledge workers in the early post-industrial or informational society. Tradition instructional methodologies based on the lecture method and one-way information flow encourages passive reception of information and ill prepares students for the modern workplace.

The Fall COMCONF exercise was designed to provide students with the types of technology used by advanced information workers. The following will review the socio-technical impact of this decision on the participating students' attitudes toward computers, CMC, and their classes.

USERS

There were five COMCONF sites on Internet or Bitnet. These classes used an E-mail interface to the RPIECS Listserver which hosted COMCONF. In addition there were three non-COMCONF classes at CSULB which were using local USENET groups as a conferencing media. Each of the COMCONF sites worked from their own syllabus. The classes were at the upper division undergraduate and Masters degree graduate level. The site/technology matrix (Table 1) shows the various classes and the technology used by each class.

INSTRUMENTATION

Each class was administered a follow-up questionnaire at the end of the term. This questionnaire included scales (scales 1-7) previously used to evaluate on-line education (Hiltz, 1990) and additional scales to evaluate learning styles, life satisfaction and fun in the classroom. Additionally, the CSULB classes were also administered scales for three personality traits (scales 13, 14, 15) which have in the past been used to evaluate various socio-technical work systems (Morse, J. and Young, D.)

SCALES

1. Computer Attitudes: Positive attitudes towards computers in general.

2. CMC Class Index: Positive attitudes toward the use of CMC in the class.

3. Attitudes Toward Course: Positive attitudes toward the class overall.

4. Attitudes Toward Instructor: Positive faculty attitudes.

5. Became more interested in subject matter: Students reported that they became more interested in the subject matter of the course.

6. Became better able to integrate and understand relationships in material: Saw relationships among the various components of the class.

7. Collaboration: Developed friendships and worked with other students in the class. Saw others' points of view.

8. Intrinsic Learner: Was self-motivated to learn. Academic orientation. (Note: scales 8-11 were scales developed by the CSULB Center for Faculty Development, 1976.)

9. Extrinsic Learner: Was motivated only to get through the class to get a grade for the class and to get a degree. Studied just enough to get by.

10. Avoidant Learner: Tried to avoid any work or learning.

11. Quality of Student Life: Self-report Semantic Differential on the students' perceived quality of life.

12. Had Fun in the Class: Self-report of the students' view of the class as fun, like a game. The students would use CMC in their classes if they were a university professor. These items were derived from David Abramis' (1990) work on the role of play in the workplace.

13. Attitudes toward Love/Affection: Stresses individualistic values as opposed to group values.

14. Tolerance of Ambiguity: Tolerant of unstructured tasks.

15. Attitude toward Authority: Wanted independence, freedom, and autonomy as opposed to dependency relationships.

RESULTS

Differences Among Sites: The differences among the five COMCONF sites and the three CSULB non-COMCONF CMC classes was tested by using discriminate analysis on the twelve variables measured at all sites. There were two significant discriminant functions. However, the plot of the scores in the discriminant space (Figure 1) showed significant cluster overlap and the crosstab of the group and predicted classifications were less than satisfactory. The author has found in several studies of student traits a very high variance among the current undergraduate population perhaps due to current open admission policies. As there were statistically significant discriminate functions but highly overlapping clusters, it was decided to cluster the students based on the 12 variables common to all sites. A K-means cluster procedure was run and the sample clustered into two stable groups. Table 2 shows the cluster centroid traits for the two clusters. Apparently the students fall into two types. A description of these types has been defined by Grenier and Metes (1992) as "work mechanics" vs. "organizational straphangers" (see Table 3 for definitions). Table 4 shows the classification of work mechanics and straphangers by class.

TABLE 2

Variable	Cluster 1 Work Mechanic	Cluster 2 Straphangers
1. Computer Attitude Index	positive	negative
2. CMC Class Attitude	positive	negative
3. Attitude Towards Course	positive	negative
4. Attitude Towards Instructor	positive	negative
5. Interest in Subject Matter	increased	no interest
6. Integrate Material	yes	no
7. Collaboration	yes	no
8. Intrinsic Learner	yes	no
9. Extrinsic Learner	no	yes
10. Avoidant Learner	no	yes
11. Student QOL	higher	lower
12. Had Fun in Class	yes	no

Process Vector Structure: An eigenvalue vector analysis was conducted to examine the factors underlying the attitudinal structure of the participants. The first analysis included only the CSULB students (N=63, 2Q@.05=.2442) and included all 15 variables measured at this site. One factor contained 37% of the total variance. Table 5 shows the factor scores for this first

major factor. Apparently the first factor taps the dimension of the work mechanic. All loadings are positive with the exception of the extrinsic and avoidant learner traits. The work mechanics also show greater tolerance for ambiguity and a greater need for independence. Of some interest is the fact that the attitude toward love/affection scale which measures a need for group vs. individual needs shows no relation to the first factor. It has been argued by some that CMC users are by nature "loners." The loading on the first factor in this study indicates that group vs. individual orientation has no relation to the work mechanic factor. In another study (Lewis, R., forthcoming) it was found that CMC adopters were more gregarious or sociable than CMC avoiders. More work will be needed to determine the interaction between personality factors and task demands and requirements.

A second eigenvalue/vector analysis was conducted to examine the factor structure on the twelve variables measured across all classes at all sites (N=158, 2Q@.05=.1552) (Table 6). In this analysis two factors were retained based on first differences and interpretability. The first factor again represents the work mechanic traits. The second factor apparently picks up an avoidant-extrinsic learner with a low quality of student life. Apparently the second factor also was associated with negative attitudes towards computers for the CSULB students but not for the students at all sites.

Factor scores were computed for the second analysis. The users are plotted on the two retained axes using the site as the plotting code in Figure 2. There is the same overlap and spread of ill-defined clusters that we saw in the discriminate analysis. However, when the plotting symbol is changed to the cluster code (Figure 3) we see that factor 1 clearly separates the work mechanics from the straphangers.

DISCUSSION

Despite difference in class content, instructional methodologies, and CMC technologies, there appear to be no discernible characteristics which clearly distinguish the class studied during the Fall COMCONF exercise. This was partially anticipated, as previous uses of CMC instructional systems at CSULB have shown few student perceived differences among BBS, CoSy and USENET as technologies to implement CMC as a classroom instructional technology. This is not to say that there are not differences in the various technologies. As an instructor I would not want to go back to the earlier BBS systems now that advanced collaborative groupware is available. From the students' perspective, however, the use of collaborative communication technologies may be such a radical departure for the traditional one-way communication flow from instructor to student that all CMC technologies appear functionally similar.

The truly distinguishing characteristics of the Fall COMCONF users was the way the users separated into the work mechanic vs. straphanger categories. Apparently the availability of CMC technologies in a classroom setting provided the more mature adult learners the resources to express themselves and to join the other mature students and the instructors in a higher quality learning experience. Note that the previous sentence referred to instructors and not instructor. In the Fall COMCONF exercise the students had available several instructors from various backgrounds to utilize as experts as needed.

The other observation is that the degree of integration of CMC into the class requirements as a fundamental part of the classroom process, and the degree of freedom the students had to choose classes, were both positively correlated with the emergence of work mechanics as opposed to straphangers in the class.

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Statistics were run using SYSTAT (Wilkinson, Leland. SYSTAT: The System for Statistics. Evanston, Ill. SYSTAT, Inc. 1990)

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Table 1
SITE TECHNOLOGY MATRIX

SITE	COMCONF	NETWORK	MAIL/CONFERENCING INTERFACE
CSULB-Leadership Class	Yes	INTERNET	DEC 5810 ULTREX/ucb mail and VM
Elite Eastern UG Business School	Yes	BITNET	VAX/VMS VAX mail
Elite Eastern Psychology Class	Yes	INTERNET BITNET	Banyan LAN Mail IBM 4381 Profs Mail
Southern Grad. School-Social Work	Yes	BITNET	IBM ES9000 CMC RICE Mail/Columbia mailer
Western Grad. Comm. Class	Yes	BITNET	IBM 3081 VM/ESA SHAFMAIL
CSULB Undergraduate Organizational Behavior Class	No		local USENET newsgroups used as a class conferencing system DEC 5810, ULTREX, EMACS/GNUS Newsmanager
CSULB Graduate CBK Class Human Resources Management (2 sections)	"		"

Table 3

WORK MECHANICS vs. STRAPHANGERS

We address ourselves to the "work mechanics" of the world: individuals who design work and provide direct or indirect value to the organization's products at every level, from the CEO to the last worker in the distribution chain. Product and organizational designers, information systems and network professionals, human resources representatives, manufacturing planners, and service delivery experts can all be work mechanics.

We differentiate work mechanics from organizational straphangers - those individuals who fill organizational slots, maybe even work long and hard hours, but don't contribute to the organization's process or progress. Work mechanics are skilled in using tools; in innovating and implementing plans, strategies, and designs; and in evolving and maintaining work processes. They are committed to the advancement and well-being of their colleagues, their organization, and their enterprise. Information is both their raw material and primary instrument: just as airplane mechanics learn to use their tools, so must information work mechanics learn to use all the available tools and resources.

Work mechanics have direct responsibility for productive input to the value-added chain, that continuum of work activities that results in the success of the organization's product in the marketplace. *Product* here is broadly defined to include all valued output along the entire chain, from the first refinement of materials - be they stone, steel, or information - to the final output of the organization or enterprise.

From: Enterprise Networking: Working Together Apart
Ray Grenier and George Metez

Table 4

Student Classification by Class

Work Mechanics	Strap-hangers	N	Plotting Symbol	CLASS	Required or optional class	Only section	Grad/UG	COMCONF or CMC required or voluntary
80.00%	20.00%	20.00	A	HRM 500 (best of term)	Req.	Yes	Grad.	Req.
81.82%	18.18%	11.00	B	HRM 446 (small section)	Opt.	No	UG	Req.
61.90%	38.10%	21.00	C	HRM 360 (OK, not exceptional)	Req.	No	UG	Req.
81.82%	18.18%	11.00	D	HRM 500 (OK)	Req.	Yes	Grad.	Req.
43.86%	56.14%	57.00	E	Elite Eastern UG. Bus. School	Req.	No	UG	Req.
70.00%	30.00%	20.00	F	Elite Eastern Psychology Class*	Req.	No	UG	Req.
33.33%	66.67%	9.00	G	Southern Grad. Class (SW)**	Opt.	Yes	Grad.	
57.14%	42.86%	7.00	H	Western Grad. Comm. Class	Opt.	Yes	Grad.	Vol.
59.62%	40.38%							
93	63	156		TOTAL				

NOTES: * Had disconnect technical problems
**Required at first, then made optional

Table 5

ALL CSULB CMC-BASED CLASSES

X(1)	0.422	computer attitude index
X(2)	0.755	class cmc index
X(3)	0.883	attitudes toward course
X(4)	0.831	attitudes toward the instructor
X(5)	0.874	became more interested in subject matter
X(6)	0.851	became able to better integrate and understand relationships in material
X(7)	0.427	collaboration
X(8)	0.296	intrinsic learner
X(9)	-0.433	extrinsic learner
X(10)	-0.622	avoidant learner
X(11)	0.401	quality of student life
X(12)	0.821	had fun in the class
X(13)	-0.064	attitude toward love/affection
X(14)	0.341	tolerance of ambiguity
X(15)	0.218	attitude toward authority (toward wanting independence)

VARIANCE EXPLAINED BY COMPONENTS

5.553

PERCENT OF TOTAL VARIANCE EXPLAINED

37.019

X04222V.410

Table 6

COMPARISON OF CSULB AND TOTAL COMCONF FACTOR STRUCTURE

(on twelve common variables)

CSULB CLASSES FACTORS		ALL CLASSES FACTORS		
1	2	1	2	
0.422	-0.388	0.421	-0.082	- computer attitude index
0.755	0.127	0.728	0.092	- class cmc index
0.895	0.225	0.700	0.283	- attitudes toward course
0.835	0.293	0.766	0.165	- attitudes toward the instructor
0.876	0.205	0.853	0.190	- became more interested in subject matter
0.862	0.098	0.808	0.096	- became able to better integrate and understand relationships in material
0.426	-0.085	0.299	-0.229	- collaboration
0.277	-0.098	0.192	-0.340	- intrinsic learner
-0.425	0.774	-0.240	0.826	- extrinsic learner
-0.612	0.611	-0.427	0.739	- avoidant learner
0.416	-0.285	0.157	-0.430	- quality of student life
0.825	0.294	0.845	0.140	- had fun in the class
45.187	12.594	35.594	14.746	

PERCENT OF TOTAL VARIANCE EXPLAINED

Figure 1
Discriminant Space

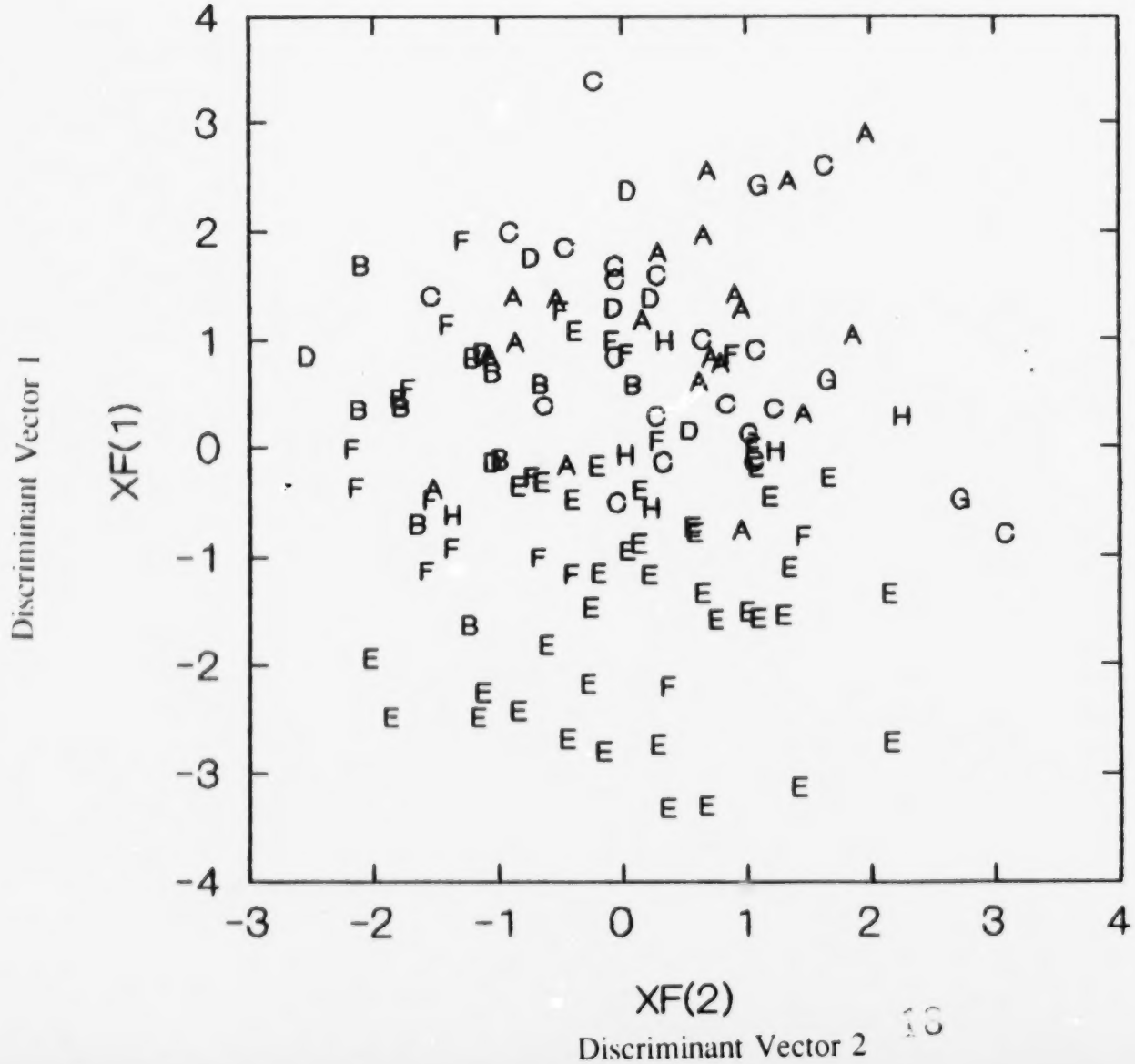

Figure 2
Factor Scores
labeled by site codes

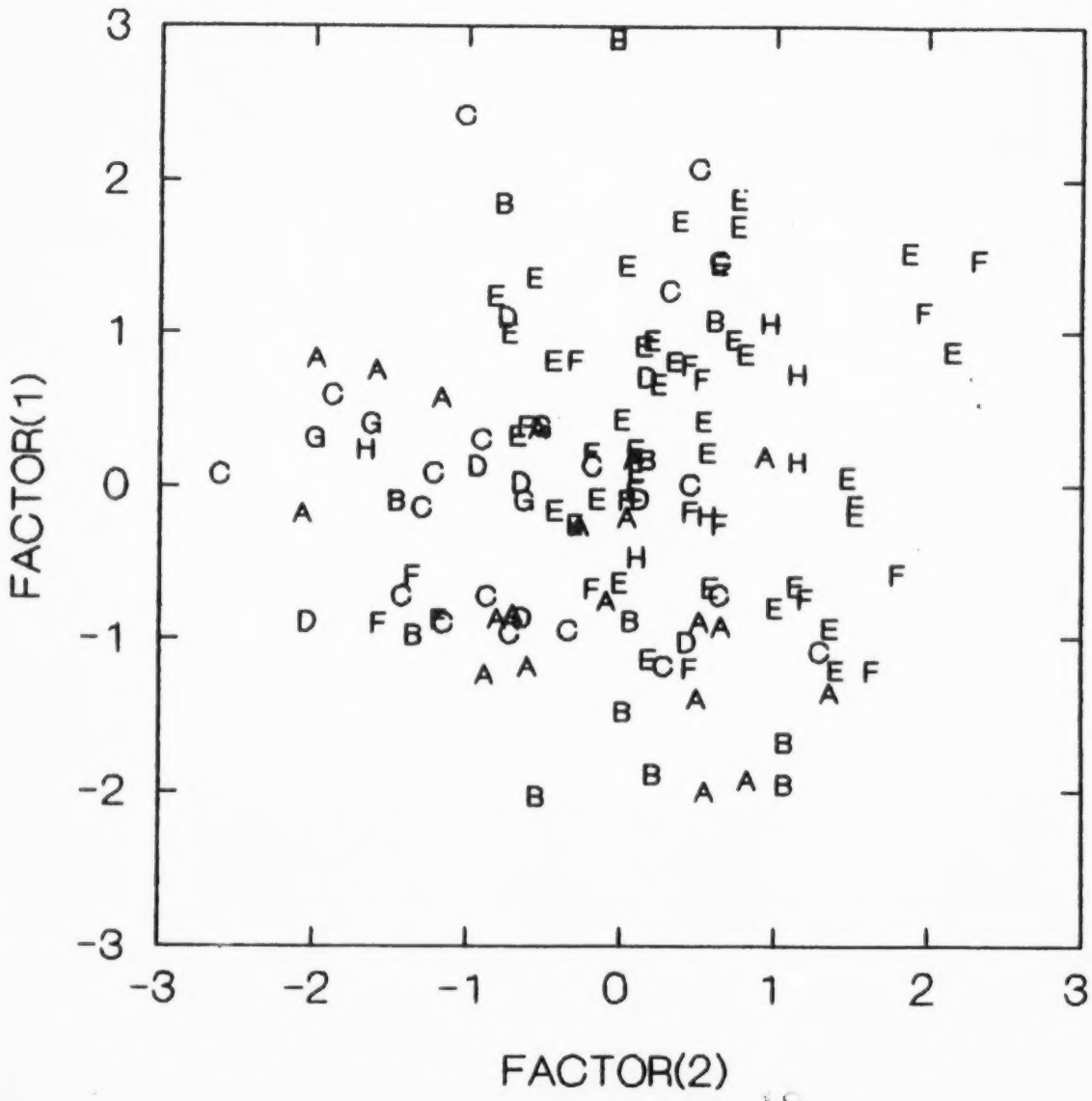

Figure 3
Factor Scores
labeled by cluster codes
0 Straphangers
* Work Mechanics